EXPERIMENTAL AND 3D SPECTRAL CHARACTERISTICS FEL WITH SPACE CHARGE

M.Volshonok, A. Gover,

Department of Electrical Engineering-

Dept. of Electrical and Electronic Engineering –

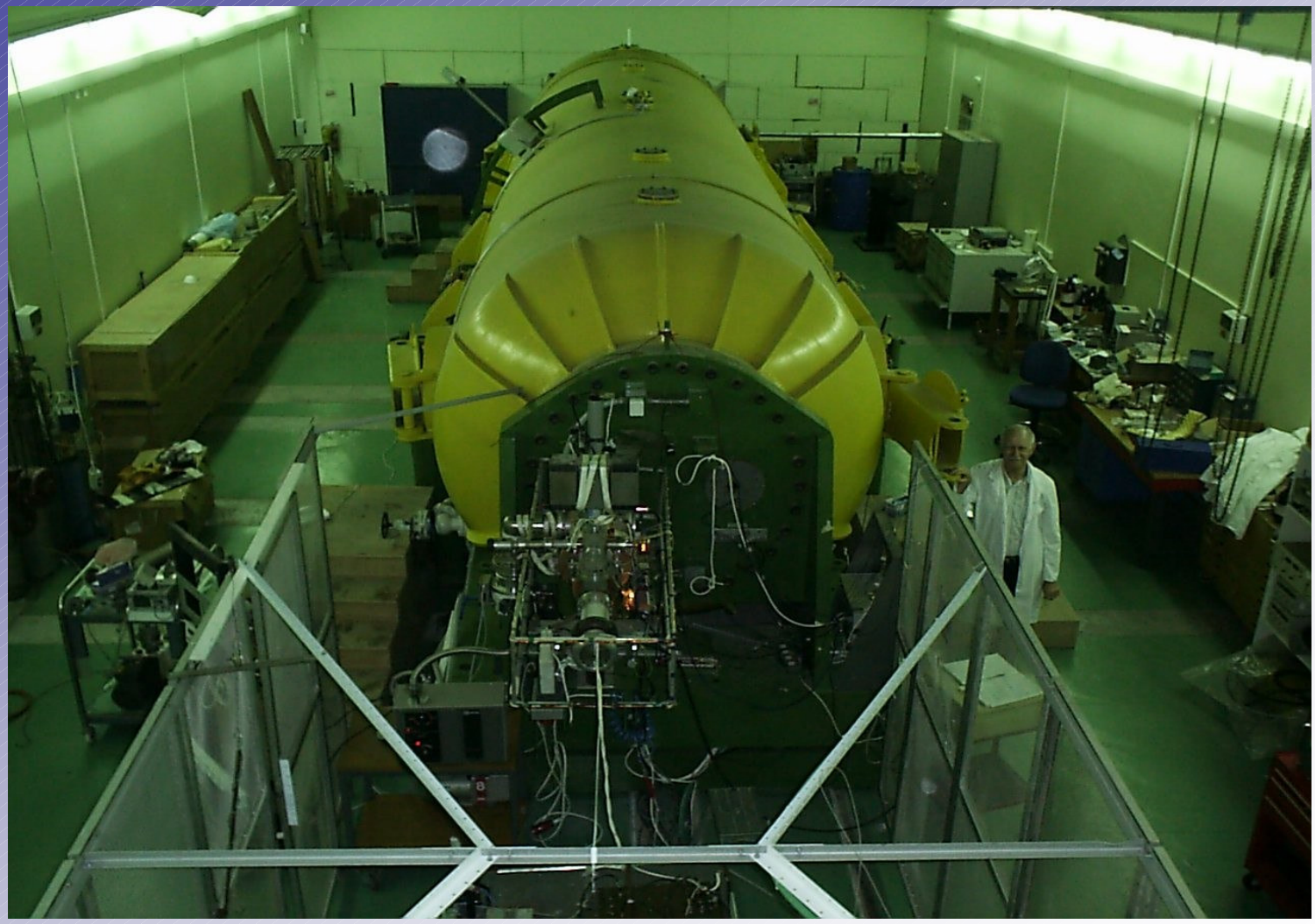
SIMULATION STUDIES OF THE OF ELECTROSTATIC ACCELERATOR DOMINATED TRANSPORT

Y. Lurie

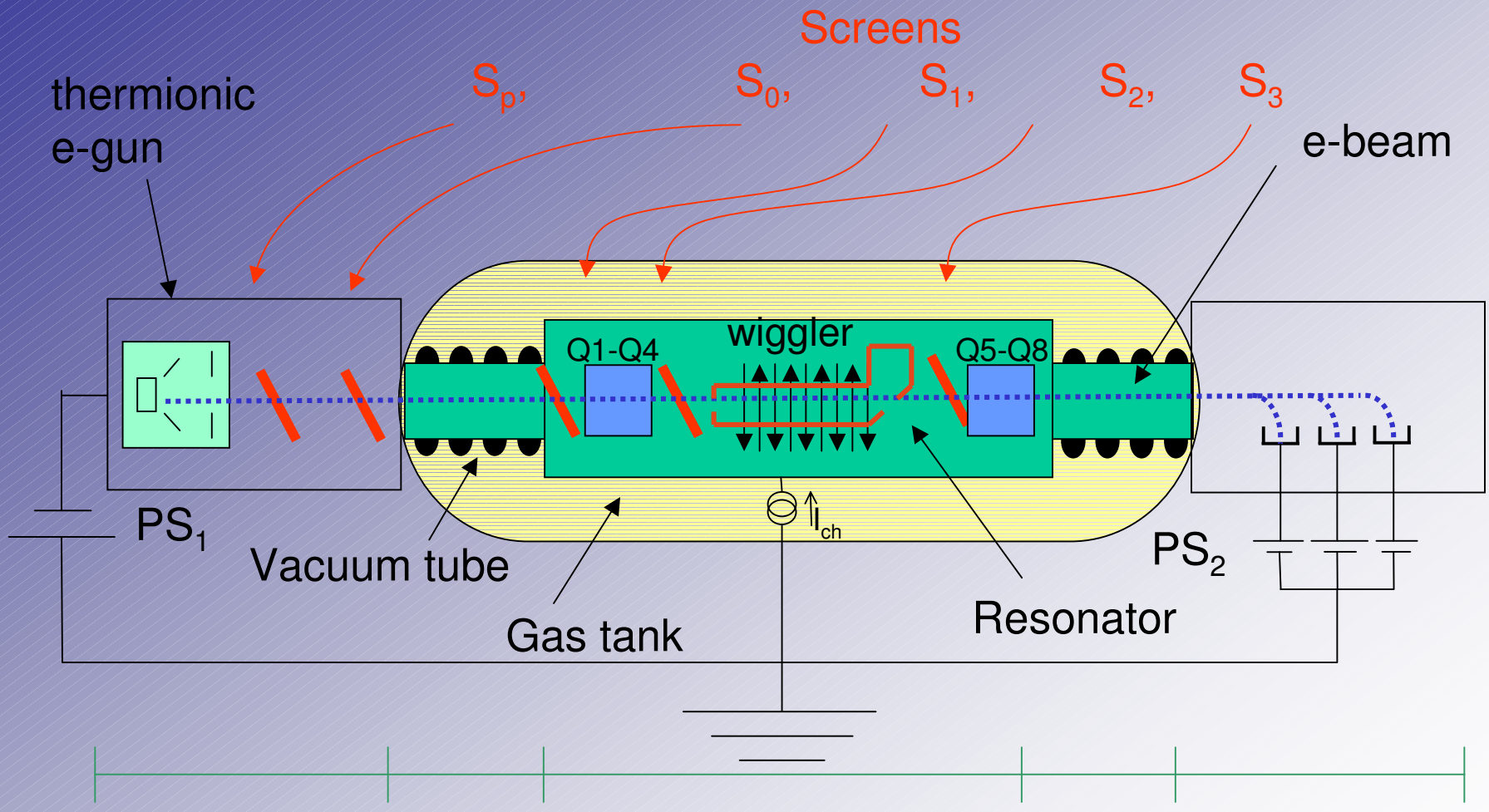
Physical Electronics,Tel Aviv University

Engineering – The College of Judea and Samaria, Ariel

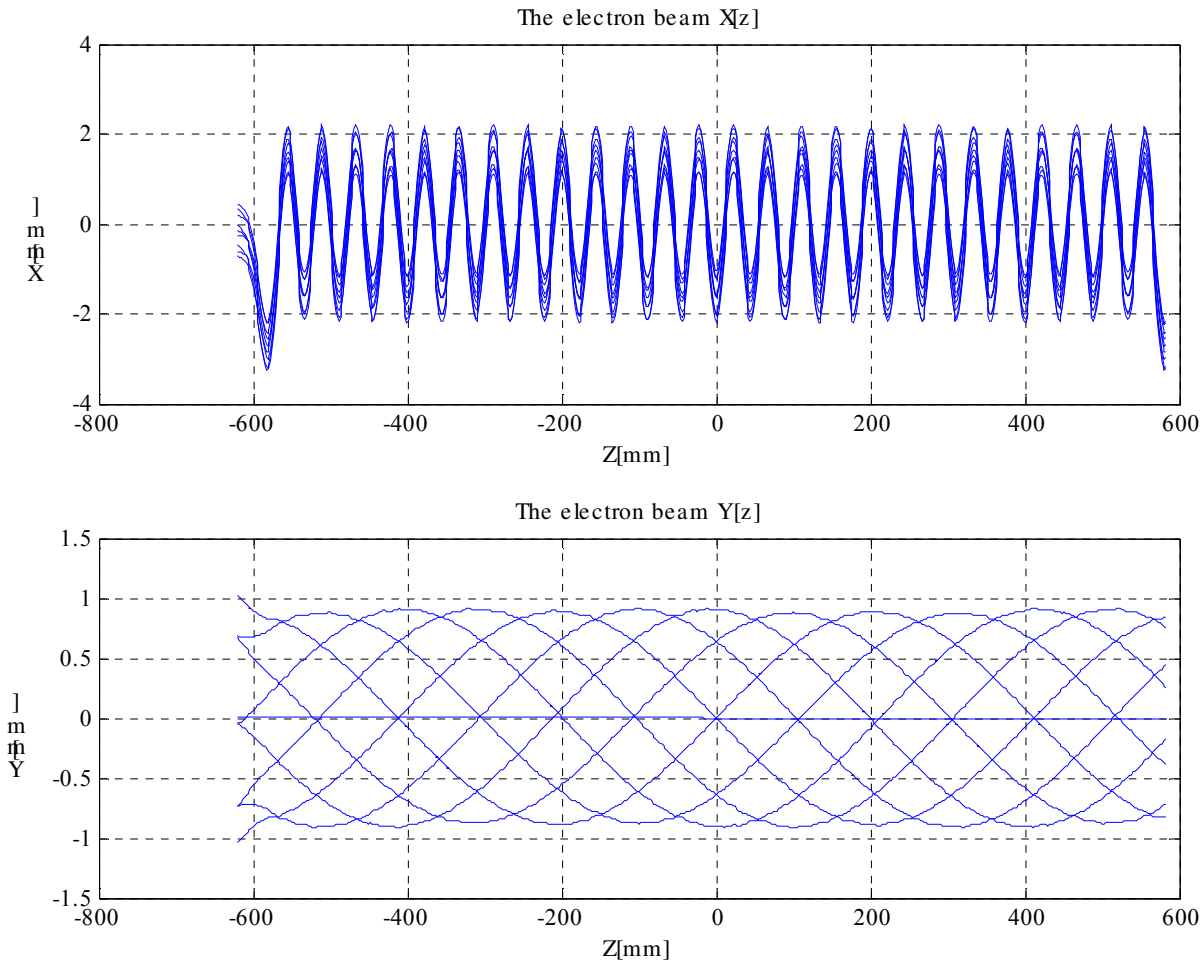
The Israeli FEL



Scheme of the FEL

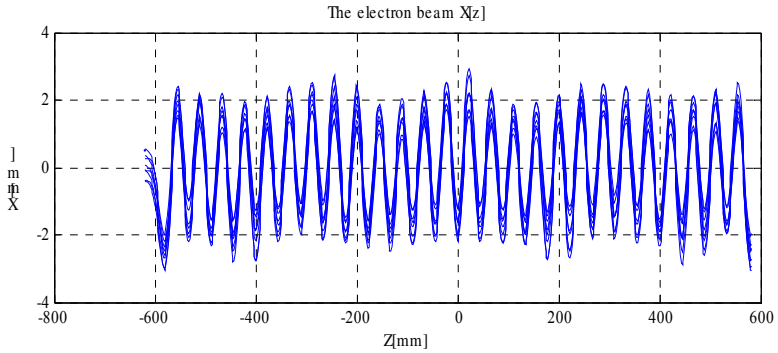


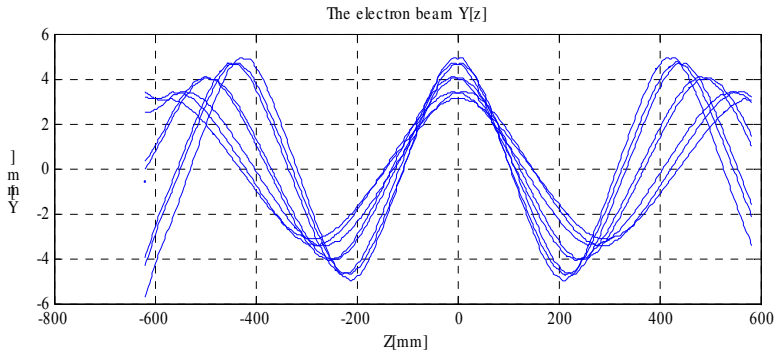
Optimal beam trajectories



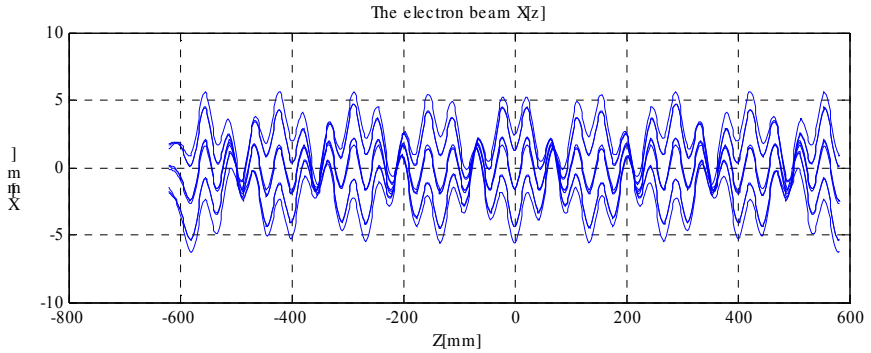
Non-ideal Beam Propagation

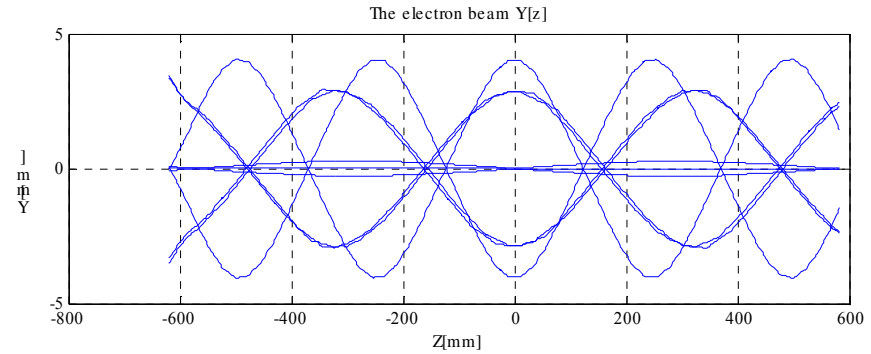
Betatron Oscilations



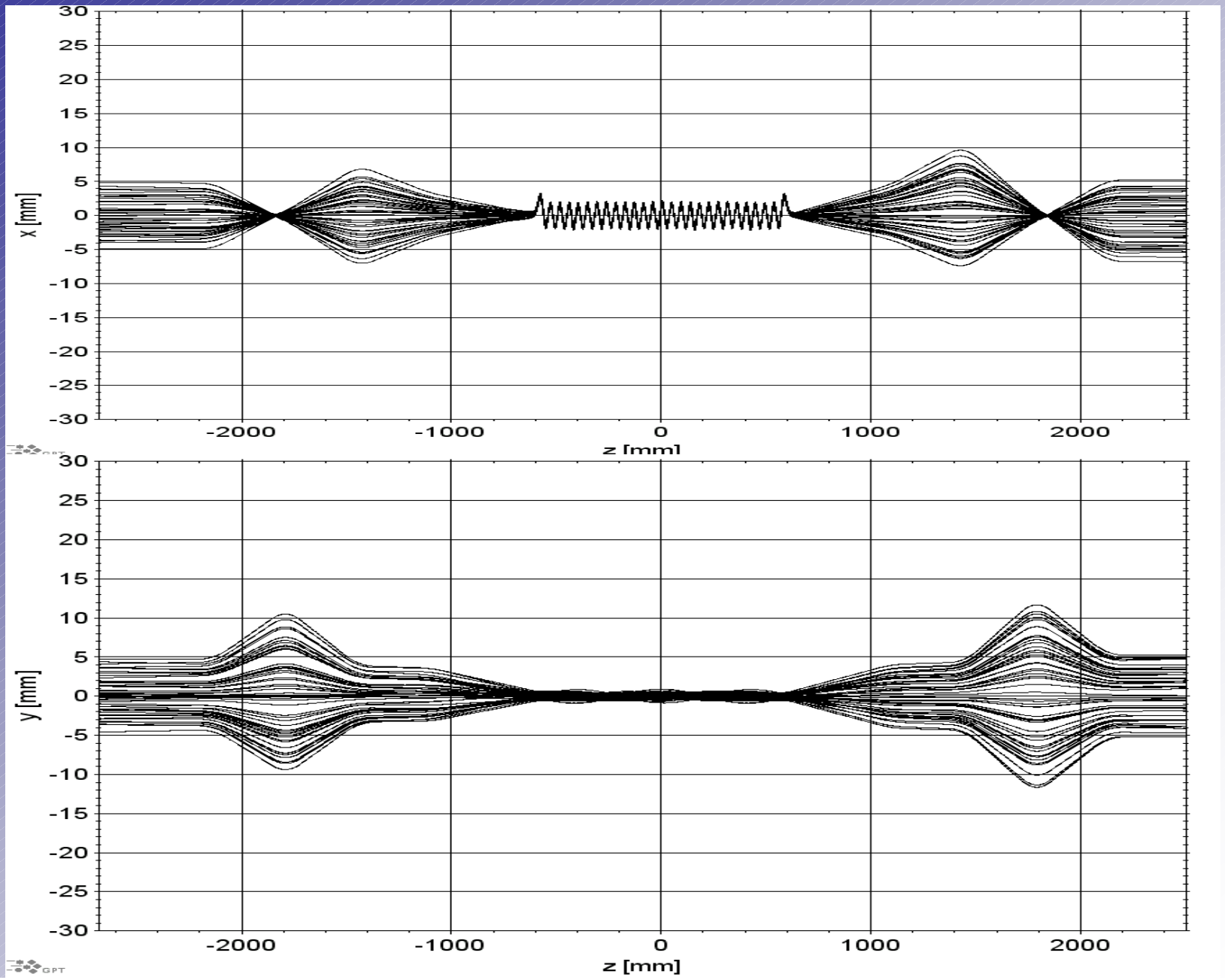


Scalloping



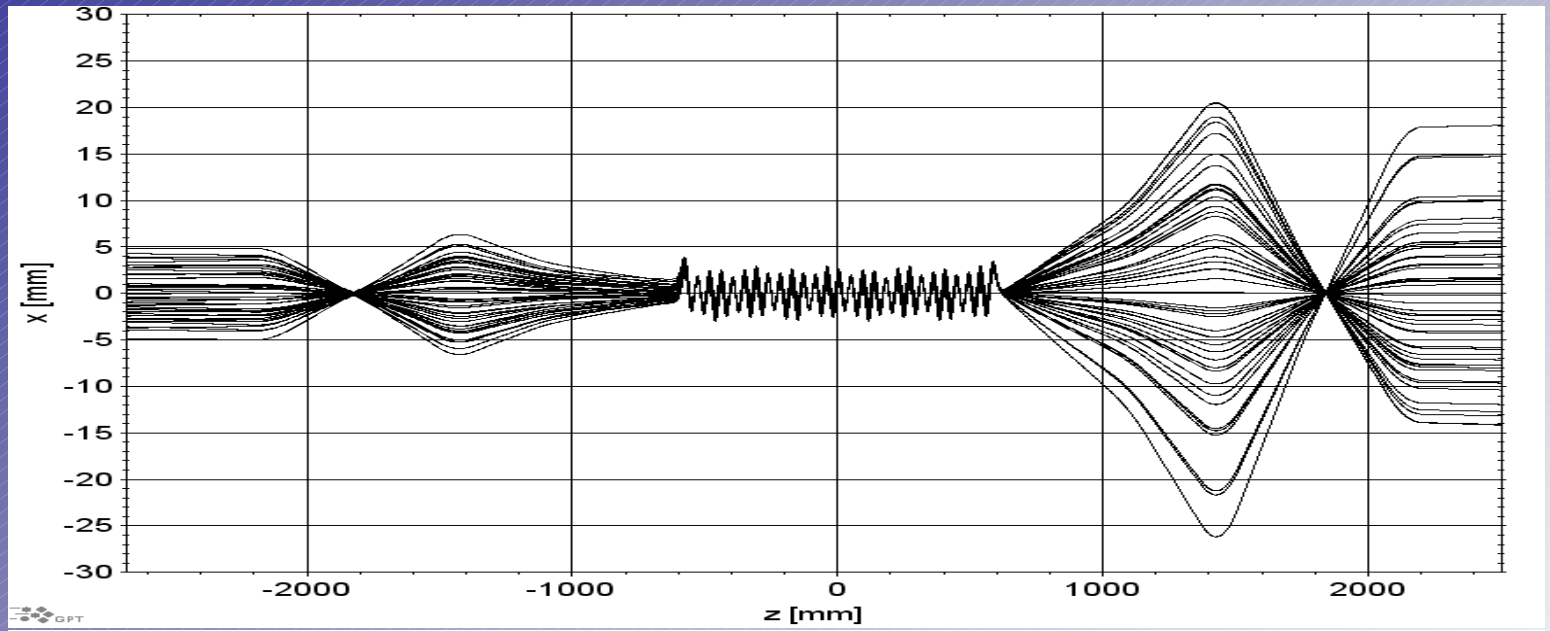


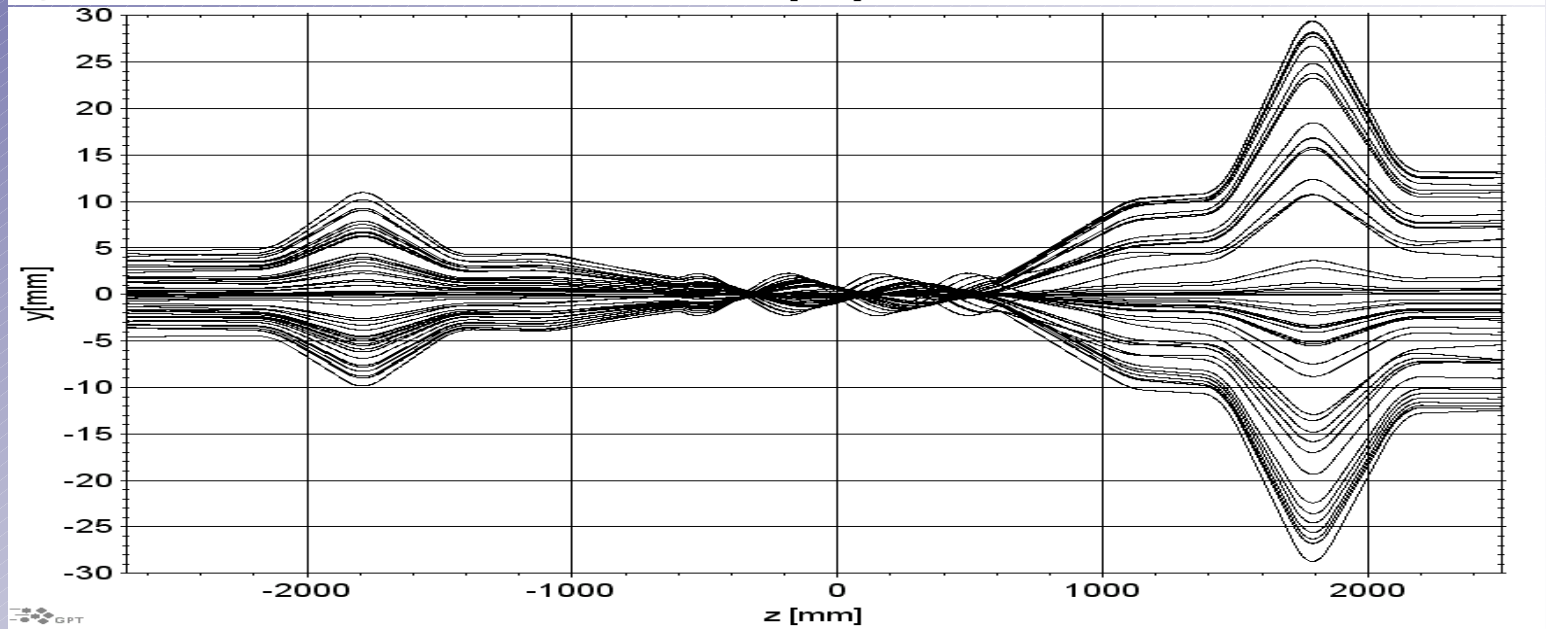
Beam radius 3 mm, E=1.4MeV ε=3π·mm·mrad 100 electrons without space-charge



Beam radius 3 mm, E=1.4MeV ε=3π·mm·mrad 100 electrons

2A current





Frequency calculation

Radiation frequency :

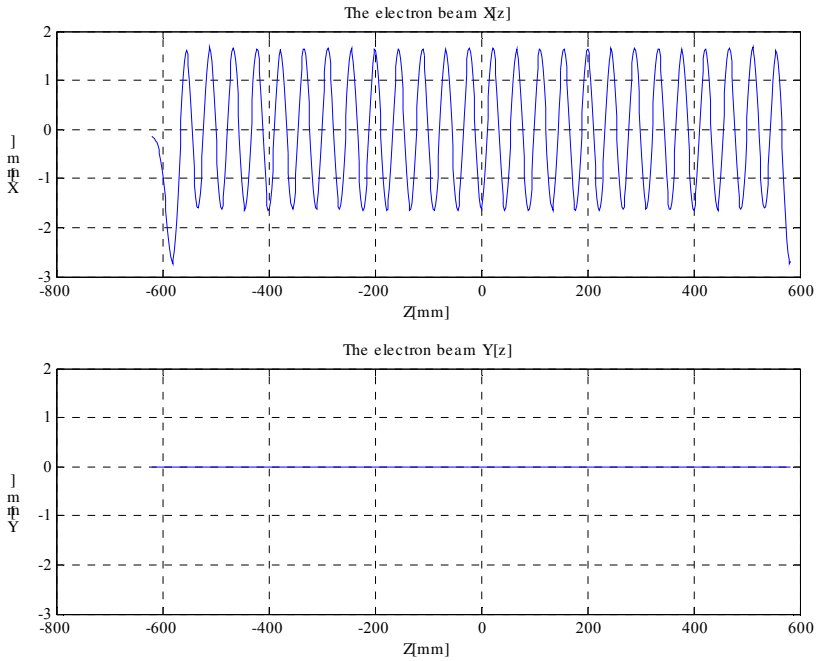
$$\omega := \gamma z0^2 \cdot \beta z0 \cdot c \cdot \left(kw + \frac{\theta max}{Lw} \right) \cdot \left[1 + \sqrt{\beta z0^2 - \frac{\omega co^2}{\left[\gamma z0 \left(kw + \frac{\theta max}{Lw} \right) \cdot c \right]^2}} \right]$$

Data

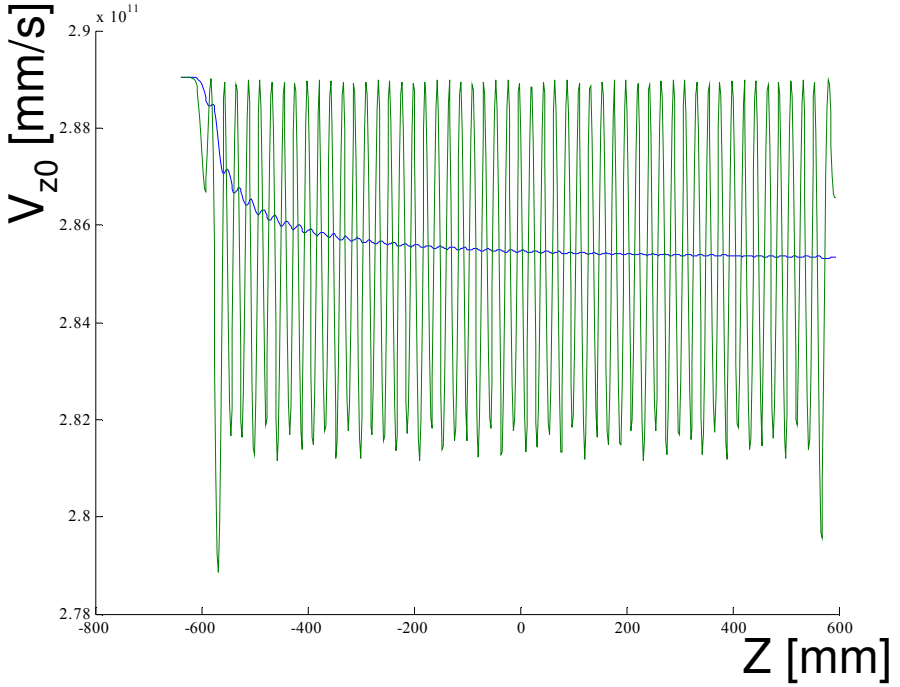
$Lw := 0.89$	[m]	Wiggler length
$kw := 141.38$	[rad/m]	Wiggler wave number
$\theta max := -2.6$		Detuning parameter for optimal gain
$\omega co := 1.046\,10^{11}$	[rad/s]	Cut off frequency

On-axis electron

Electron trajectory



Electron velocity

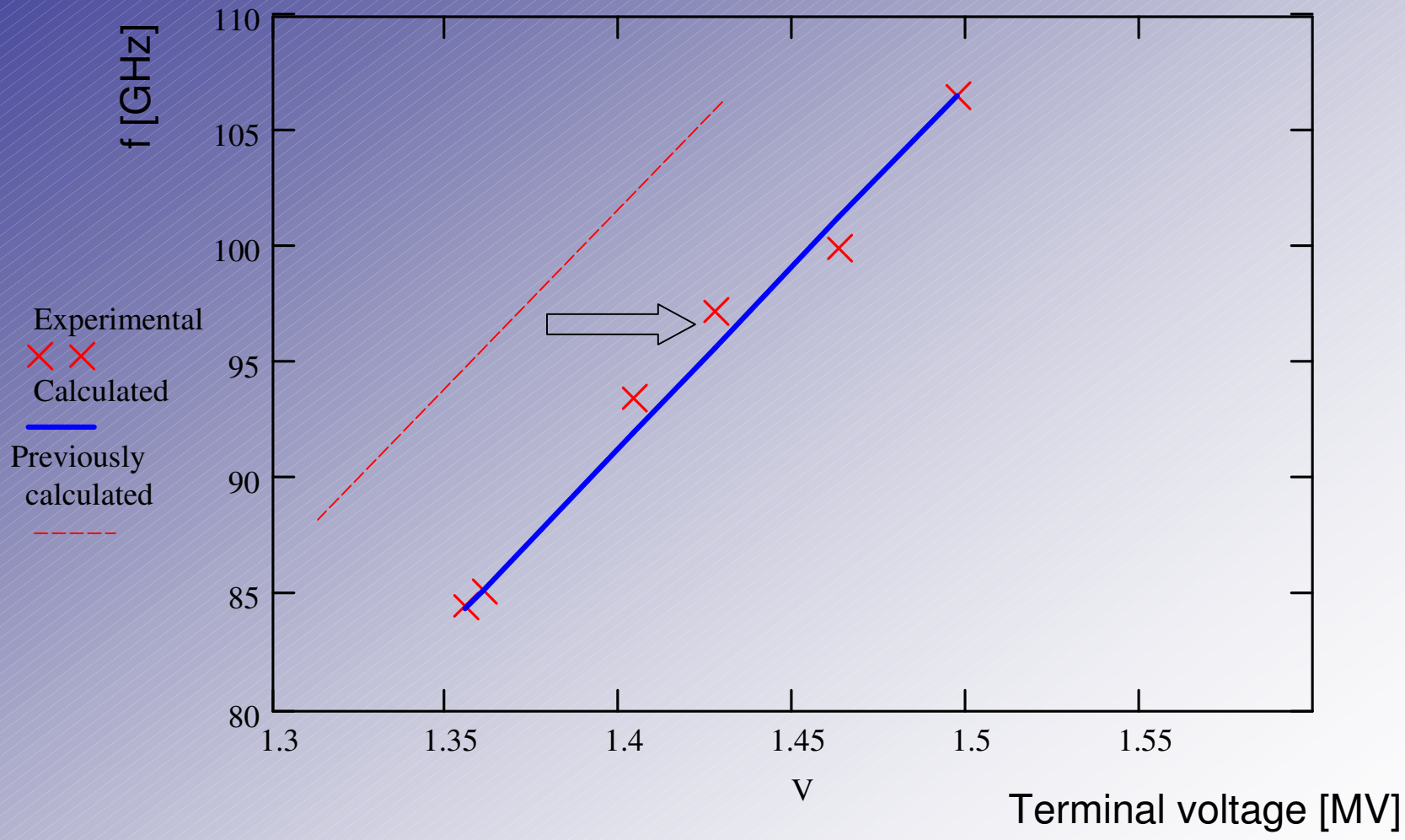


Electron average velocity $V_{z0} = \frac{z - z_0}{t(z)}$ For $V_{z0}=2.854\cdot10^8$[m/s]

V=1.4 [MeV]

Radiation frequency f=105[GHz]

Frequency shift effect



Gain reduction